PSYCHOLOGY.

THE RELATION OF WILL TO THE CONSERVATION OF ENERGY.[1] —It is generally supposed that the designed movements of animals exhibit the quality of design by reason of a direct influence exercised by conscious states. It is supposed that an animal eats and drinks because it *feels* hungry and thirsty; that it changes its position because it *feels* that position to be uncomfortable, on account of muscular weariness, unpleasant temperature, or some other reason which is consciously felt by it. Such acts are termed voluntary. They are distinguished from the automatic, which are performed either in the absence of consciousness of them or without that relation of consciousness to them which is seen in the voluntary acts. The peculiar influence exercised by conscious states over acts is termed *the will.* Ordinary will must be distinguished from "free will," since its action is a necessary outcome of "motives" or reasons which pre-exist in the mind; while "free will" is supposed to be spontaneous in its action. With the latter supposititious faculty I have nothing to do in the present paper.

The physiological action of will is as follows, so far as it has been possible to trace it. An impression or stimulus received by a sensory nerve—generally at the surface of the body—is conveyed by it to the posterior column of the chorda spinalis, and is thence transmitted through the optic thalamus to some point in the gray tissue of the posterior lobe of the cerebral hemisphere. Thence a stimulus is conveyed by some of the fibres of the white substance to the anterior part of the gray cortex. Thence it returns downwards, conducted by white fibres, to the corpus striatum, and thence to the anterior column of the spinal cord. From this the stimulus is conducted along the motor nerve to the appropriate muscle, where it releases energy, the muscle contracts, and the act is performed. Modifications of this general procedure depend on the source of the original stimulus, whether from an organ of special sense or from an internal organ, etc., and the part towards which the outgoing stimulus is determined.

The locality at which the outgoing stimulus receives its direction is evidently in the cells of the cortex of the lateral and anterior part of the hemisphere. This is evidently the seat of the will.

I must here recall the familiar fact that multitudes of acts which display distinct design are performed by animals without consciousness having any share in the process. There are good reasons for believing, however, that such acts could never have originated in a state of unconsciousness of the actor. I will not enter this subject

[1] Abstract of a paper read before the Philosophical Society of Washington, May 26th, 1888.

fully, but state in brief what the two principal reasons for this belief are. The first is that, according to our experience, animals which meet with conditions injurious to life which do not cause them pain speedily succumb and perish. It is incredible that animals not conscious of hunger, thirst, and changes of temperature should not speedily die. Animals not conscious of fear of more powerful enemies must be destroyed. The second reason for this opinion is, that all designed acts whose history we can trace are the result of *education*. This means, conscious stimuli strong enough to hold the attention and the repetition of movements appropriate to the stimulus and designed to either retain or escape it, according as it is pleasant or painful. Then follows the acquisition of the power of performing such movements with ease, the consequent withdrawal of attention, and ultimately the absence of consciousness of the performance of the act. This is the process of cryptopnoy,[1] by which acts pass from the voluntary to the automatic stage. There is reason to believe that this is the process by which animals have acquired the various remarkable habits which characterize them and which they pursue with such unvarying precision. But most—perhaps all—animals have not, in so doing, abnegated consciousness. They generally possess enough to enable them to act intelligently in the presence of new occasions and to acquire new habits and add to their stock of automatic capacities. This may be better understood by reflecting on the long ages of geologic time during which they have had the opportunity for such education.

I add here that it is highly probable that the movements thus inaugurated and perpetuated have been made the conditions of the environment, the active factor in animal evolution, since it is probably due to such action that the organography of animals has been determined. This is the probable source of the origin of those variations on which natural selection acts. And the view that organic evolution is due to the consciousness at the back of automatism has been called the doctrine of Archæsthetism.[1]

From this digression I return to the question of the nature of the act of will.

The animal organism is a machine for the metamorphosis of energy; and the evidence is clear that this process is performed in strict accordance with the law of the conservation of energy. The exact relation between the amount of work done and the amount of food ingested is well known, whether that work be muscular, mental, or reproductive. The energy which does the work is liberated by the decomposition of the proteids which constitute the food. These highly complex substances break up, and are replaced during work by simpler and more stable ones, which are eliminated from the organism; while the energy which has maintained them is given up and appears as heat, muscular contractions, thought-force, etc.

[1] Origin of the Fittest.

The animal machine is the most perfect converter of energy known, acting with far less waste than any apparatus of human invention.

Every mental act involves conversion or metamorphosis of energy, whether it be a mere sensation or a memory, an emotion, ratiocination or a determination of will. Throughout these processes the law of conservation of energy is necessarily obeyed. But mental acts possess qualities which require further attention in this connection. Mind, *as such*, is not a form of energy. Reducing mind to its generalized expression,—that one which embraces all its phenomena,—viz., consciousness, it is safe to say that its qualities, and hence its definition, are totally distinct from those which we ascribe to, and by which we characterize energy. Energy is motion in one form or another. Consciousness is self-knowledge, from the simplest sensation upwards. No two subjects of thought can be more widely diverse. In fact, it is safe to say that all thinkable things are traceable to three sources;—matter energy, or the motions of matter, and consciousness, or the knowledge which some matter has of itself. But I assumed at the outset of this paper, in common with most other persons, that designed acts are due to the direction and control of currents of energy exercised by conscious states. In this proposition there appears to be involved an assumption that in an act of will the law of the conservation of energy is violated. This, indeed, appears at first sight to be the state of the case; and it becomes necessary that we examine most fully into the process. It is not assumed that energy is created by an act of will, but it is supposed that energy is directed. The creation of energy is unthinkable. Let us see whether the idea of its direction by some thing which is not energy is a fact of experience or not. Believing, as I do, that consciousness, and hence will, is a phenomenon of a material tridimensional basis, and disclaiming the dualistic idea that consciousness is external to and apart from tridimensional matter, it is necessary to explain how such an attribute or quality is capable of exercising control of the movements of such physical basis. Having already expressed the belief that it does so, let us look into the *modus operandi*. I believe that this may be expressed by the following law. *The dynamic expenditure of an act of will has no dynamic relation to the nature of the decision involved in it.*

This law may be illustrated as follows, in the case of the lower animals. An animal which is pursued by another may run into a hole or it may ascend a tree for safety. In the two cases totally different sets of muscles are used. The animal, *for reasons*, elects to use the one set rather than the other set. Another animal may throw one ear forward to catch a sound rather than the other ear. Mechanisms to accomplish the movements of both exist. In this case the animal *directs* the energy to one set of muscles rather than to the other. Or an animal will use both ears alternately, or turn the head from side to side to hear and see what is behind, each time choosing which muscles it will move. This is only the common will of the animal

acting from the simplest of motives—not free, of course, but none the less a remarkable property of protoplasm, conscious and unconscious. No inorganic machine can do this.

What relations do these decisions bear to the amount of energy expended in the resulting act? A physical movement costs energy, and a mental act costs energy. The mental activity incident to a decision of will costs energy, and the more perfectly ratiocination is performed, the more perfectly is the energy consumed and the less dissipated, as heat. But does the decision to use the left hand, eye, or ear cost more or less than the decision to use those of the opposite side? Evidently not. Does the decision to climb a tree cost more than the decision to enter a hole? I venture to say that it costs a man no more to decide to build a house than to decide to stand a brick on end, so far as the act itself is concerned. This is because the act is the outcome of a process of ratiocination or feeling, in which the dynamics are not correlated to the forms of the sensations embraced under those two terms. The fact of anything being done *for reasons* indicates that it takes its direction from other than dynamic sources. The question of the decision is quite different from that of acquiring motives of action. This is a more complex process, for motives are reached by very various routes. But even in attaining motives there can be no equivalency between the energy expended and the mental result.

Of course it may be said that there is no separate act involved in a decision of will. It may be correctly said that the determination is simply due to the predominating pressure of the most important and weighty motives. Let this be accepted as true. It is consciousness, past or present, which knows which are the weighty motives. Like the prism which bends the course of the rays of light, whatever passes through the psychical connection between incoming and outgoing stimulus is determined in accordance with what it finds there, and it is consciousness and its residua which is responsible for the bending. The physiological labor is performed in acquiring the motives which, when acquired, perform acts of will which are incommensurate with energy, both with regard to their own intrinsic qualities and with regard to the objects towards which they act. It is this property of mind which enables it to direct the movements of matter without violation of the law of the conservation of energy.

This fact is of the utmost importance to philosophy and to our conceptions of the universe and of the place of consciousness in it. These decisions, which we term will, are common to all conscious beings, from the bottom of the scale up. Every animal which selects an article of food or which rejects one, for *reasons*, lowly and simple though they be, performs an act of will, and directs energy, and in so far appears to be superior to the law of the conservation of energy. With the lapse of consciousness, such as we see in the vegetable kingdom, acts of will—prop-

erly so called—are impossible. Their automatic residua remain to work blindly forward until such time as the environment changes to unfavorable conditions, when the organism perishes without remedy.—*E. D. Cope.*

ARCHÆOLOGY AND ANTHROPOLOGY.[1]

Fraudulent Spear or Arrowheads of Curious Forms.—We have just received a series (eight in number) of these curious-shaped spear or arrowheads which were transmitted to us for our inspection. We were not informed whence or from whom they were purchased, nor who was suspected in connection therewith. But a slight examination developed the fact that they were spurious. The material used was black and jaspery flint or chert which takes no *patine* with age or exposure. The fresh fractures have much the same appearance as have the ancient ones. A critical examination, however, under the miscroscope, and in other ways knows to the archæologist accustomed thereto, detected the fresh chipping done at the places necessary to make the curious form. We were thus enabled to supply the outline where it had been chipped away, and could see the genuine implement as it was before subjected to the dexterous manipulation, or slight of hand, of this modern manufacturer of spurious flints. Five of the specimens had been made from the common leaf-shaped spear or arrowhead. In two cases stemmed arrowheads were used, and the last was triangular with a concave base. From these original and genuine forms the manipulator had made his curious forms. The originals were worth, say, two cents a piece, but after being subjected to his adroitness their price would be increased to fifty or seventy-five cents. A fine speculation! A law is sorely needed in the United States by which these fine gentlemen can be prosecuted for such deceitful practices, as they now can be for passing base money.

[1] This department is edited by Thomas Wilson, Esq., Smithsonian Institution, Washington, D. C.